

CHROMOSOME NUMBERS OF MISCELLANEOUS UNITED STATES DICOTYLEDONS

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During my academic year at the Department of Botany, Smithsonian Institution, Washington, D.C., in 1970–1971, I had the opportunity to make collections of material for cytological study. A previous report on this study, listing chromosome numbers of some Asteraceae, has been published (Kovanda, 1972). In the present paper, chromosome counts for 38 collections are reported. These include 36 taxa of specific rank, representing 31 genera and 15 families. The majority of these counts reinforce earlier observations and support current studies in cytogeography. In some taxa, the present counts confirm the presence in the United States of two or more chromosome races. New ploidy levels are established for *Solidago flexicaulis* and *Krigia virginica*. Chromosome counts are reported for the first time for *Ranunculus micranthus*, *Stellaria gonomischa*, *Cubelium concolor* and *Senecio eremophilus*. Notes on previous cytological work, variation and geographical distribution have been added wherever appropriate but no attempt has been made to produce generalizations of a taxonomic or evolutionary nature.

MATERIALS AND METHODS

The material upon which the present counts are based was collected from different localities in Washington, D.C., Maryland, Virginia, Tennessee, Colorado, New Mexico, Arizona, Nevada and California. To count the somatic numbers, tips were taken from primary roots of young seedlings grown in Petri dishes. The techniques were identical to those described in my 1972 paper. Determinations of gametic chromosome numbers were made by the use of squashes of pollen mother cells. For these studies, young flower buds of the various species were collected in the field and fixed in Carnoy solution. After a period of 24 to 48 hours, the fixative was replaced by 70 per cent ethyl alcohol in which the material was held without refrigeration until it could be examined. The anthers were stained in lacto-propionic orceine, but for *Aquilegia canadensis* and *Saxifraga virginiana* aceto-carmin was used.

as a stain. Meiotic behavior was quite regular in all the species investigated. Voucher specimens for all of the plants examined are on deposit at the Herbarium of the National Museum in Prague (PR). Those collection numbers preceded by K. are by Kovanda; by K.&S., Kovanda and Shetler.

OBSERVATIONS

CARYOPHYLLACEAE

Silene acaulis (L.) Jacq. ssp. *acaulescens* (T. N. Williams) Hitch. & Maguire

Colorado, Grand County: Berthoud Pass, 12400 ft., K.&S. 3313.
 $2n = 24$.

This circumboreal species, embracing a host of infraspecific taxa, has been counted many times on both New and Old World material (for references, see Fedorov, 1969) but no variation in the chromosome number was observed.

Stellaria gonomischa Boivin

Colorado, Grand County: Berthoud Pass, 12400 ft., K.&S. 3328.
 $2n = 26$.

This is possibly the first report for one of the segregates of *Stellaria umbellata* Turcz. The latter sensus stricto seems to be the only member of sect. *Umbellatae* which has been counted previously, with $2n = 26$ (Zhukova, 1967). Hartman's (1971) report of $2n = 26$ for a Wyoming collection of *S. umbellata* Turcz. may be referable either to *S. gonomischa* Boivin or to *S. weberi* Boivin.

RANUNCULACEAE

Aquilegia canadensis L.

Maryland, Montgomery County: Bear Island, K. 4031. $n = 7$.

Ranunculus abortivus L.

Virginia, Fairfax County: Turkey Run, K. 4059. $n = 8$.

Ranunculus micranthus Nutt.

Virginia, Fairfax County: Turkey Run. K. 4081. $n = 8$.

While several reports are available for *Ranunculus abortivus*, *R. micranthus*, which is closely related, has as yet been chromosomally unknown (Keener, 1976).

BRASSICACEAE

Arabis laevigata (Muhl.) Poir.

Maryland, Montgomery County: Bear Island, K. 4043. $n = 7$.

SAXIFRAGACEAE

Saxifraga virginiana Michx.

Maryland, Montgomery County: Bear Island, on rocky ledges, K. 4025. $n = 14$.

Virginia, Fairfax County: Difficult Run, dry open wood, K. 4047. $2n = 28$.

The chromosome numbers reported here represent the first counts for United States plants of this species and correspond with one based on a collection from near Tulibi Lake, Manitoba (Löve & Ritchie, 1966).

FABACEAE

Desmodium dillenii Darl.

Maryland, Montgomery County: Dry wood on road from Cabin John to Cabin John Bridge, K. 3526. $2n = 22$.

The report of $2n = 22$ concurs with three counts presented for meiotic material from North Carolina and Connecticut (Young, 1940). The genus seems to be entirely diploid, based on $x = 11$.
Oxytropis deflexa (Pall.) DC.

Colorado, Park County: 2 mi. N. of Fairplay on Route 9, 9900 ft., K.&S. 3374. $2n = 16$.

VIOLACEAE

Cubelium concolor (Forst.) Raf.

Maryland, Montgomery County: Plummers Island, K. 4166. $n = 24$.

The huge genus *Cubelium*, mainly tropical in its geographical distribution, is poorly known cytologically. The limited data available (Gadella et al., 1969; Davidse 1971) would indicate that at least two polyploid series are present, one based on $x = 6$, the other on $x = 8$. *Cubelium concolor*, which does not appear to have been previously counted, obviously fits within this pattern.

ONAGRACEAE

Ludwigia alternifolia L.

Virginia, Fairfax County: Great Falls of the Potomac, *K. s.n.* $2n = 16$

The only chromosome counts made hitherto in this species are $n = 8$ and $2n = 16$ for var. *pubescens* Palmer & Steyerm. from Florida (Gregory & Klein, 1960).

PLUMBAGINACEAE

Armeria maritima (Mill.) Willd. var. *californica* (Boiss.) G.H.M. Lawr.

California, Marin County: Ocean View, on coastal bluffs, *K. 6156.* $2n = 18.$

POLEMONIACEAE

Phlox divaricata L.

Maryland, Montgomery County: Bear Island, *K. 4024.* $n = 7.$

Phlox subulata L.

Maryland, Montgomery County: Bear Island, *K. 4022.* $n = 7.$

HYDROPHYLLACEAE

Phacelia dubia (L.) Trel.

Maryland, Montgomery County: Plummers Island, *K. 4175.* $n = 5.$

BORAGINACEAE

Mertensia virginica (L.) Pers.

Washington, D.C.: Moist alluvial wood along the Potomac River, between Three Sisters and Chain Bridge, *K. 4016.* $n = 12.$

To date, all of the members of this genus have had the base chromosome number of $x = 6$ (e.g., Britton, 1951; Sokolovskaya, 1968).

RUBIACEAE

Houstonia caerulea L.

Maryland, Montgomery County: Bear Island, *K. 4031.* $n = 16.$

This wide-ranging species has been shown to consist of three

chromosomal races, diploid ($n = 8$), tetraploid ($n = 16$) and hexaploid ($n = 24$) of which the first is more southern in its distribution. Only tetraploids have been reported from Maryland (Lewis & Terrell, 1962).

CAMPANULACEAE

Campanula divaricata Michx.

Virginia, Warren County: Along Skyline Drive, near Stony Man, K. 3573. $2n = 34$.

This is a curious member of subsect. *Heterophylla* of the genus *Campanula*, aberrant in any of the proposed serial subdivisions (Kovanda, 1977). The count of $2n = 34$ is in agreement with the only previously published record based on a West Virginia collection (Gadella, 1964). A reported count of $2n = 40$ (Darlington & Janaki-Ammal, 1945) is doubtfully correct.

ASTERACEAE

Tribe Astereae

Acamptopappus shockleyi A. Gray

Nevada, Nye County: Beatty, on road to Daylight Pass, K. 5728. $2n = 18$.

This species has been reported as having $n = 9$ by Raven et al. (1960) from Esmeralda County, Nevada.

Erigeron pulchellus Michx.

Virginia, Fairfax County: Difficult Run, K. 4234. $2n = 18$.

Erigeron simplex Greene

Colorado, Grand County: Berthoud Pass, 12400 ft., K.&S. 3329. $2n = 18$.

This species is now known to be composed of at least two chromosome races, one diploid, with $2n = 18$, one tetraploid, with $2n = 36$ (Wiens & Halleck, 1962; Taylor & Brockman, 1966). Montgomery and Yang (1960) have reported a triploid number, $2n = 27$, for cultivated material from the Royal Botanic Garden, Edinburgh. The species would clearly be worth a thorough cytogeographical study.

Solidago flexicaulis L.

Maryland, Montgomery County: Bear Island, K. 3631. $2n = 27, 36$.

Previous counts have revealed that *Senecio flexicaulis* comprises

diploid ($2n = 18$) and tetraploid ($2n = 36$) cytotypes (Beaudry & Chabot, 1959; Solbrig et al., 1964; Kapoor & Beaudry, 1966; Beaudry, 1969; Kapoor, 1970). Their geographical distribution does not appear to form a definite pattern but the simultaneous presence of triploids and tetraploids in one locality would indicate that they are at least partly sympatric. No diploids were found in the present collection but they are known to occur in Maryland (Kovanda, 1972).

Solidago speciosa Nutt. var. *pallida* Porter

Colorado, Larimer County: Rist Canyon, about 8 mi. W. of Bellevue, 6800 ft., K.S. 3164. $2n = 36$.

The tetraploid chromosome number reported here is in accord with Beaudry's (1963) results for this species. Morton (1970) has, however, counted $n = 9$ for var. *rigidiusculus* T. & G. from Missouri, indicating the presence of at least two ploidy levels within this variable species. A detailed study is needed to ascertain whether this variation in chromosome number is correlated with the taxonomic treatment. The collection upon which the present count is based may be referred to var. *pallida* Porter, but differs in having densely hairy achenes.

Tribe Heliantheae

Bebbia juncea (Benth.) Greene

Arizona, Pima County: Robles Ranch, on road to Ryan Field Coffee Shop, K. 5255. $2n = 18$.

Bidens tenuisecta A. Gray

New Mexico, Santa Fe County: Sangre de Christo Mountains, along the Chamisa Trail, K. 3446. $2n = 24$.

The count of $2n = 24$ is the second report for this species and the first for a United States collection (Turner & Johnston, 1961).

Chrysogonum virginianum L.

Maryland, Montgomery County: Cabin John, K. 4216. $n = 16$.

This number was reported previously by Jones (1968) for material from Georgia.

Helianthus annuus L.

California, Fresno County: Squaw Valley, K. 5891. $2n = 34$.

Madia elegans D. Don ssp. *vernalis* Keck

California, Tulare County: Three Rivers, K. 5819. $2n = 16$.

Tribe Senecioneae*Arnica mollis* Hook.

Colorado, Grand County: Berthoud Pass, 12400 ft., K.&S. 3321.
 $2n = 38$.

This is another species containing two cytotypes, one diploid, with $2n = 38$, one tetraploid, with $2n = 76$, the latter being apparently more common (Ornduff et al., 1967). The only diploid record was from Jackson County, Colorado. Additional determinations are required to correlate the cytological information with morphological variation.

Senecio aureus L.

Maryland, Montgomery County: Bear Island, K. 4032. $n = 22$.

Washington, D.C.: Theodore Roosevelt Island, K. 4292. $n = 22$.

Senecio douglasii DC.

California, Fresno County: Squaw Valley, K. 5890. $2n = 40$.

Senecio eremophilus Richards

Colorado, Summit County: Alluvial ground at Breckenridge, K.&S. 3369. $2n = 40$.

This seems to be the first count for the species, placing it at the same level as *Senecio ambrosioides* Rydb., the only member of sect. *Eremophili* which has been counted previously (Ornduff et al., 1967). Assuming that the basic chromosome number of the majority of the Senecioneae is $x = 10$ (Ornduff et al., 1963), *S. eremophilus* is to be regarded as a tetraploid.

Tribe Cichorieae*Hieracium gronovii* L.

Tennessee, Henry County: Puryear Clay Pit, K. 3072. $2n = 18$.

Hieracium venosum L.

Maryland, Montgomery County: Great Falls of the Potomac, K. 4181. $2n = 18$.

This count, made from young corolla tissue, confirms previous reports by Gustafsson (1933), Smith (1966) and Jones (1968).

Hypochoeris glabra L.

California, Fresno County: Squaw Valley, K. 5893. $2n = 10$.

Krigia virginica (L.) Willd.

Virginia, Fairfax County: Great Falls of the Potomac, K. 4231.
 $2n = 20$.

The only previous report for *Krigia virginica* was diploid, $2n = 10$

(Stebbins, Jenkins, & Walters, 1953). Surprisingly enough, the Great Falls gathering proved to be tetraploid, with a chromosome complement of $2n = 20$. Obviously, two ploidy levels exist within this species, and further study is needed, to determine possible differences in their morphology, habitat requirements and geographical distribution.

Youngia japonica (L.) DC.

Maryland, Montgomery County: Chesapeake and Ohio Canal, picnic area near Lock 14, K. 4223. $n = 8$.

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